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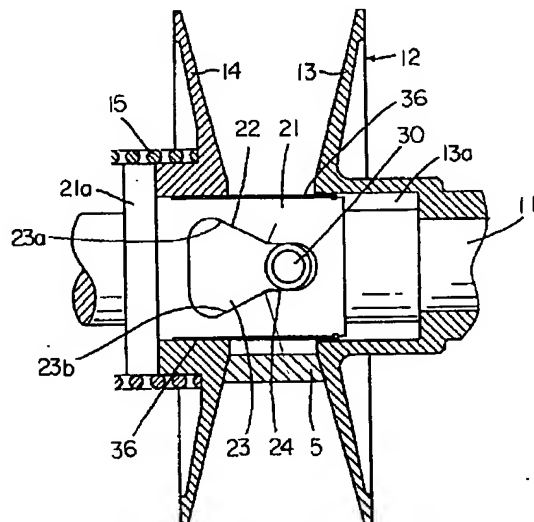
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(54) 【発明の名称】 ベルト式無段変速機

(57) 【要約】

【課題】 無段変速機の変速時トルクカム装置で高速域から低速域の変速全域でスリップの発生を防止する。

【解決手段】 ベルト式無段変速機において、従動軸11の可動プーリに共動可能に備え、軸線に対称で軸方向にカムフォロア30が接触しうる三角形のカム孔23と、該カム孔の先端に連続してカムフォロア30が摺動しうる軸心と同一方向に延びる溝孔24とからなるカム面22を形成した可動ボス部材21と、該カム面に接触させるカムフォロア30を設けた従動軸11とからなるトルクカム装置20を備えたものである。



## 【特許請求の範囲】

【請求項1】 駆動軸に備える可変プーリと、従動軸に固定された固定プーリと該従動軸に遊合された可動プーリとを対向させて備え、該可動プーリの背後にスプリングを弾装して可動プーリを固定プーリに常時押圧状に備えてなる可変プーリとにベルトを巻き掛けした変速装置において、

従動軸の可動プーリに共動可能に備え、軸線に対称で軸方向にカムフォロアが接触しうる三角形のカム孔と、該カム孔の先端に連続してカムフォロアが摺動しうる軸心と同一方向に延びる溝孔とからなるカム面を形成した可動ボス部材と、該カム面に接触させるカムフォロアを設けた従動軸とからなるトルクカム装置を備えたことを特徴とするベルト式無段変速機。

【請求項2】 前記従動軸の軸心にオイル貯留部を設け、かつ前記オイル貯留部と前記カム面とを連通するオイル孔を設けたカムフォロアを従動軸に備えた請求項1記載のベルト式無段変速機。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】この発明は産業機械、工作機械、自動車等で回転数の高速制御、頻繁な正逆回転、高負荷変動する駆動手段に使用されるトルクカム装置を備えたベルト式無段変速機に関する。

## 【0002】

【従来の技術】従来、この種のVベルト変速装置として、図8および図9に示す駆動装置のドライブ軸と回転一体の第1可変径プーリと、ドリブン軸110に固定された固定プーリ113とドリブン軸に遊合された可動プーリ114とを対向させて備えた第2可変径プーリ112とがVベルト105で伝導され、第2の可変径プーリ112は可動プーリ114背後に弾装されたバネ115によって可動プーリ114を固定プーリ113側に押圧するとともに可動プーリのボス部117に三角形カム面121を持ち、変速域の低速から高速まで軸線に対する傾斜角が一定で、ドリブン軸にカム面と接触する接触子130が設けられたトルクカム装置120を備えたものがある（実公平5-40354号公報参照）。

## 【0003】

【発明が解決しようとする課題】前記したVベルト変速装置のトルクカム装置120では、可動プーリのボス部に設ける三角形カム面51は全ストローク $l'$ で、変速域の低速から高速まで軸線に対する傾斜角が一定であり、低速域における正逆転では、三角形のカム面121の間隔 $B'$ が必要以上に広いために正転から逆転に変わると、変速ベルトが緩み、スリップが発生する。すなわち、接触子が加速時にはカム面121aに接し、減速時にはカム面121bに接するが、三角形の低速側、すなわち三角形の底辺側は間隔 $B'$ が広いために加速から減

速に、減速から加速に変速するとき、一方のカム面から他方のカム面に移る広い間隔の途中でカムに負荷がかからないで、カムが遊び可動プーリが戻ろうとするために可動プーリとベルトに緩みを生じてベルトがスリップが発生する。三角形の頂点の高速側でも両側が傾斜面であるためにトルクの僅かな変動でも接触子が動くために可動プーリとベルトとの間に滑りを生ずる。また、一方回転時においても低いトルク時、VベルトおよびVベルトの接触径が変化し、可動プーリと固定プーリの位相がずれ、カム面と接触子の位置が極端に離れ、この時急速に高負荷になったとき、スリップが発生することがあるなどの問題がある。また、回転中で変速時は変速しないときに比べ、静摩擦係数から動摩擦係数に移るので、摩擦係数が半分となり、プーリとベルトの伝達能力が半減する。従って、一旦ベルトがスリップが発生すると、負荷トルクが減少しないかぎりスリップが続くためベルトの接触面が炭化し、ついにはそれが原因でベルトの破断が生じる。この切れたベルトが滞積するとその廃棄が公害の問題ともなる。

20 【0004】この発明は上記従来の問題点を解決するために、カム面を三角形のカム孔と直線の溝孔とからなる独特の形状のカム面として、変速時の高速域から低速域の変速全域でスリップの発生を防止しうるトルクカム装置を備えたベルト式無段変速機を提供することを目的とする。

## 【0005】

【課題を解決する手段】この発明の請求項1のベルト式無段変速機は、駆動軸1に備える可変プーリ2と、従動軸11に固定された固定プーリ13と該従動軸に遊合された可動プーリ14とを対向させて備え、該可動プーリの背後にバネ15を弾装して可動プーリを固定プーリに常時押圧状に備えてなる可変プーリ12とにベルトを巻き掛けした変速機において、従動軸11の可動プーリ14に共動可能に備え、軸線に対称で軸方向にカムフォロア30が接触しうる三角形のカム孔23と、該カム孔の先端に連続してカムフォロアが摺動しうる軸心と同一方向に延びる溝孔24とからなるカム面22を形成した可動ボス部材21と、該カム面22に接触させるカムフォロア30を設けた従動軸11とからなるトルクカム装置20を備えたことを要旨とする。

40 【0006】請求項2の発明は、請求項1記載のベルト式無段変速機において、前記従動軸11の軸心にオイル貯留部40を設け、かつ前記オイル貯留部と前記カム面とを連通するオイル孔を設けたカムフォロア30を従動軸11に備えたことを要旨とする。

【0007】前記した第1の発明の構成によれば、前記遊動ボス部材に設けるカム面を、三角形のカム孔と軸線方向に延びた溝孔とを連続形成したので、カム孔のストロークが短く、しかも低速側の間隔を狭めることができ、変速装置の変速時にカム面の低速側において、カム

フォロアに対してカムが遊ぶことなく、一側の傾斜面から他側の傾斜面に移行して直ぐに負荷がかかり、従って、可動プーリが戻ることがないので、可動プーリとベルトに緩みを生じず、ベルトのスリップが発生しない。また高速側は溝孔としたので、カムフォロアは回転方向に動くことなく、軸方向に摺動されるので、可動プーリとベルトとの間に滑りを生ずることはない。従って、回転数の高速制御、頻繁な正逆回転、高負荷時において、変速機の従動側のプーリとVベルトに緩みを生ずることがなく、スリップを生じないので、ベルトの接触面が炭

10 化することなく、長期間使用できる。従って、ベルトの廃棄量が少なくでき、公害の防止に役立つ。

【0008】前記した第2の発明の構成によれば、オイル貯留部とカム面とをカムフォロアのオイル孔を通じて連通してオイル貯留部に貯留したオイルをカム面に常時供給しうるので、前記カム面の摩擦、摩耗を防止でき、長期に渡り注油することなく、円滑に変速できる。

【0009】

【発明の実施の形態】この発明の実施形態を図面に基

10 いて説明する。図1はこの発明のベルト式無段変速機の断面図、図2は可変プーリ的高速時の横断面図、図3は同縦断面図、図4は可変プーリの低速時の横断面図、図5は同縦断面図、図6はカム面の拡大平面図、図7は従動軸と可動ボス部材の要部拡大断面図である。

【0010】図1において、この発明のベルト式無段変速機の実施形態を示す。Aはモータ等の駆動装置、1は駆動軸（入力軸）、2は駆動側の可変プーリ（可変Vプーリ）で、固定プーリ3、可動プーリ4が備えられている。5はVベルト、6は変速機のケーシング、7は可動プーリを進退操作する操作ハンドルで、駆動軸に関連し

30 て備えられている。モータのスイッチの入切で、駆動、停止が行われ、駆動中に加速、減速、変速が行われる。11は従動軸（出力軸）、12は従動側の可変プーリ（可変Vプーリ）で、従動軸に固定された固定プーリ13と該従動軸に遊合された可動プーリ14とを対向させて備えられ、可動プーリ14の背後のバネ受け16との間にバネ15が弾装され、可動プーリが常時固定プーリ側へ付勢して備えられている。バネ受け16は従動軸11の外周に固定される。17は軸受けベアリングである。前記駆動側の可変プーリ2と従動側の可変プーリ1

40 2にVベルト5が巻き掛けされる。駆動装置はモータに限るものではなく、各種エンジンを使用できる。

【0011】この発明は上記した無段変速機において、トルクカム装置の構造を改良したものである。図2乃至図5において、無段変速機の従動側の可変プーリ的高速時と低速時におけるトルクカム装置を示す。前記従動軸11を該従動軸に可動可能に備える可変プーリ2との間にトルクカム装置20が備えられる。従動軸11に備える可変プーリ2の可動プーリ14の軸部の内面と従動軸11との間に可動ボス部材を装着する嵌合孔14aが設

けられ、他方の固定プーリ13には軸部に可動ボス部材が摺動しうる所定ストロークのガイド孔13aが形成されている。カム面を形成した可動ボス部材21は従動軸11に嵌合し、かつ前記可動プーリ14の嵌合孔14aに嵌合して固定されて共動しうるように備えられ、固定プーリ13に対して可動プーリ14が軸方向に摺動可能でかつ円周方向にも回転しうるように備えられている。

【0012】図6および図7において、この発明のトルクカム装置20では、可動ボス部材21は基端に環状の

20 鈎21aを有する金属製円筒体で、その円筒体の周囲の1個所にカム面22が形成される。この可動ボス部材21は稼働プーリ14の嵌合孔14aに嵌合され、鈎21aがプーリの軸部の端部に当接されて固定され、共動可能とされる。可動ボス部材21の周囲に設けるカム面22は軸線に対称で軸方向にカムフォロアが接触しうる三角形のカム孔23と、該カム孔の先端に連続してカムフォロア40が摺動しうる軸心と同一方向に延びる溝孔24とにより構成される。すなわち、カム面22は三角形のカム孔23と直線状溝孔24とを結合した2段カムとされる。

【0013】カム孔23は固定プーリ側から可動プーリ側に向け、軸方向外側へ向かって広がる三角形で、軸線から対称にカム面23aとカム面23bとが周囲に向かって傾斜角が一定に設けられる。この三角形のカム孔23はストロークが短くでき、しかもその傾斜角度はベルトの側圧強度に応じて締める負荷との関係で決まるので、低速側の間隔を小さくできる。直線状溝孔24はその内径をカムフォロア30の外径とほぼ同径とし、軸心（軸線）と同一方向に直線状に設けられ、溝孔がカムフォロア30に対して軸方向にのみ摺動可能とする。溝孔24の長さは中速域以上或いは高速域対応で長さを設定する。なおカム孔と溝孔の接続部はアールを付けて滑らかな曲線状とする。また、カム孔23の端面の両側もカムフォロアの径が合致しうる曲面とする。カム面22を三角形のカム孔23と直線状溝孔24とで構成するのは、低速域ではカムのストロークを小さくし、カム孔の一方の傾斜面と他方の傾斜面との間隔を狭めることで、正逆変速時にカムフォロア30の移行距離を小さくしてカムの遊びを無くすことでベルトの滑りをなくすことができること、そして、中速域以上或いは高速域ではベルト張力を与える可動プーリのバネによる狭圧力が強いためにカムの傾斜による加圧力が不要であり、カム面の傾斜面は設ける必要なく、軸線方向の直線状溝孔のみにしても不都合がないことを見出したので、高速側のカム孔の先端に軸線方向の直線状溝孔24を設け、カム面の不必要な部分を無くし、低速時と高速時にいずれにおいてもカムとカムフォロアとの関係を遊び無く変速し得るようにする。

【0014】図6において、トルクカム装置20のカム面22の全体の長さLは従来のカム面の全長L'とほぼ

同じで、そのうち三角形のカム孔23の長さをL1、直線溝孔24の長さをL2とする。カム面22のカム孔23の長さL1と直線溝孔24の長さL2の比率は、カムがベルトの側圧強度に応じて締める負荷との関係で決められる。実施例ではカム面22は、L1がL2より若干長く設定してある。カム孔の軸線に対する傾斜角度は、ベルトの側圧強度に応じて締める負荷との関係で傾斜角度を決める。例えば、カム孔の軸線に対する傾斜面の角度を約45度以下とする。図では約30度の傾斜としてある。また高速域の溝孔24の長さも中速以上ではベルトにかかる力が小さく、トルクも小さいので、それに適した長さとする。また、カム孔23の最大幅Bは変速時にカムフォロア30が滑らない間隔とする。この間隔は従来例に示したカムの間隔よりはかなり狭くして、カムフォロア30が一侧の傾斜面と他側の傾斜面とに直ぐに接触でき負荷をかけることができるので、カムの遊びがなくベルトの滑りを生ずることがない。なお、カム面22は、L1がL2より若干長く設定してあるが、これに限定されるものではなく、前記したようにベルトの側圧強度に応じて締める負荷との関係で、三角形のカム孔の大きさを大小設定することができ、また実施形態では中速域以上で直線状の溝孔としてあるが、これに限定されるものではなく、中速域、高速域における増速、減速のトルク等の関係で溝孔の長さを長短設定できる。

【0015】カムフォロア30の構造は図10に示すように、カムフォロアは頭部30aを若干大きい径とした金属製軸体で、その下部にネジ31が設けられ、かつ頭部30aには外周面に環状の溝32が形成されて、該環状溝にリング33が回転自由に備えられ、該リング33の外周面がカム面22と接触して転動し得るように設けられ、カムフォロア30がカム面22に対して円滑に転動しうる。このカムフォロア30の中心に上端から下端までオイル孔34が貫通して設けられ、かつ上部の前記リング32の内面に相当する位置には中心のオイル孔34から周方向に放射状に1又は複数のオイル孔35が設けられ、オイルをリング33の内面に供給し得るようにする。このカムフォロア30は前記カム面内に突出させ、該カムフォロア30をカム面22に位置させ、駆動中はカムフォロア30に対してカム面を接触せしめる。駆動中回転方向への力で円錐板のプーリが中へ締め込まれ、その締め込まれる力がカムにかかり、カム面がカムフォロアに圧接状態とされ、カム面が加速、減速の変速時にカムフォロアに沿って移動して可動プーリと可動ボス部材は共動して固定プーリに対して摺動される。

【0016】従動軸(出力軸)11には軸心の軸方向に所定長さのオイルを貯留するオイル貯留部40が形成され、このオイル貯留部40から外周のカム面までに半径方向にカムフォロアを固定する貫通孔41が設けられる。この貫通孔41の上部にはカムフォロア30の頭部30aに備えるリング33の外径より若干大きい径でそ

の頭部の下部が若干入る深さの楕円状に凹部41aが形成され、かつ貫通孔の下部にカムフォロア30のネジ31が螺合するネジ孔42が設けられる。そして、従動軸11の貫通孔41の外側でかつ楕円状凹部41a内で、カムフォロア30のリング33の外側の位置に1又は複数個所に貯留部より外周の凹部41aまで通じたオイル孔43が形成される。実施形態では、オイル貯留部40は軸端より軸線方向に所定長さの穴44が形成され、穴の入口に蓋体45が備えられ、オイル貯留部40内部に所要量のオイルを入れて貯留する。而して、リング33は内外面にオイルが常時遠心力でオイル孔を通じて出されて供給される。この従動軸11のネジ孔42に前記カムフォロア30のネジ31が螺合されて頭部のリング33が外周の凹部41aに位置して、凹部より突出して備えられ、前記可動ボス部材20のカム面22に接触される。カムフォロア30のオイル孔34を通じてオイル貯留部40からカム面22にオイルが常時供給され、また、オイル孔35よりリング33の内面とオイル孔43を通じてオイル貯留部40からリング33の外周面を通じてカム面22にオイルが常時供給される。

【0017】オイルを密封する構造として、可動ボス部材21の円筒体の外周にカバーの肉厚分に相当する段部が形成され、その段部より端部近くまでの外周に前記カム面22の全体を覆う円筒状ボスカバー36が嵌められ、端部で止め部材39で止められて固定される。該可動ボス部材21の内面と従動軸11の外周面との間にはオイルール37が備えられ、かつボス部材21の外周とボスカバー36との間にOリング38が備えられ、オイルが外部に漏れないようにされる。

【0018】この発明は前記した構成なので、駆動中は従動軸のカムフォロア30に対して可動プーリと共動する可動ボス部材のカム面を接触せしめる。すなわち、低速域では加速時、減速時にカムフォロアに対してカム面が傾斜面に沿って移動され、高速域では軸方向に移動される。また、正逆の変速時にはカムフォロア30に対してカム面の一方の面から他方の面に速やかに移行させ、遊びを生ずることなく変速する。

【0019】図1乃至図3の高速時には、Vベルト5が駆動側で可変プーリの外径、従動軸側で可変プーリの内径に位置して、従動軸11の可動プーリ14は固定プーリ13から離反し、バネ15は圧縮されて強い状態にあり、このとき従動軸11のカムフォロア30に対して可動プーリと共動する可動ボス部材21のカム面22の溝孔24が嵌合され、この状態で入力軸から出力軸が駆動される。例えば、この状態で減速するとカムフォロア30はカムの溝孔に沿って軸方向に摺動される。そして、カムフォロア30に対して溝孔24が摺動して出ると回転方向への力で円錐板のプーリが中へ締め込まれ、その締め込まれる力がカムにかかっているためカムの傾斜面がカムフォロア30に沿って移動される。

【0020】図4および図5の低速時には、Vベルト5が駆動側で可変プーリの内径、従動軸側で可変プーリの外径に位置して、従動軸11の可動プーリ14は固定プーリ13に接近し、バネ15は伸びて弱い状態にあり、このとき従動軸11のカムフォロア30に対して可動プーリと共動する可動ボス部材21のカム面22は傾斜面が接しており、この状態で回転方向に入力軸から出力軸が駆動される。この状態で駆動側を逆転するとカムフォロア30に対して一方のカム面23aから逆トルクカム面23bに移行される。そして、カム面23aと23bの間が従来の半分以下であるから瞬時にカムフォロア30に対して逆トルクカム面23bが接して、回転方向への力で円錐板のプーリが中へ締め込まれ、その締め込まれる力がカムにかかっているためカムの傾斜面がカムフォロア30に沿って移動される。

【0021】この発明は変速域を低速域と、中速、高速域とに分けたとき、中速域以上ではカムフォロアが直線の溝孔に入ることで、バネの狭圧力のみで十分所定トルクの伝達ができ、また、低速域のみに、三角形のカム機構で狭圧して所定のトルクを伝達でき、従って、高速域から低速域の変速全域でスリップの発生を防止し、ベルトの巻き込みを防止する。三角形のカム孔はストロークが短く、しかも低速側の間隔も小さくしたので、一方のカム面から他方のカム面に移る間隔を狭くでき、低速域で正逆の変速を行うときカムフォロアがカム面の一方の傾斜面から反対の傾斜面に直ぐに接することになり、カムが途中で遊ぶことがないので、可動プーリが戻ることがなく、可動プーリとベルトに緩みを生じず、ベルトのスリップが発生しない。また、高速側は軸線方向の溝孔としてカムフォロアを軸線方向に所定ストロークだけ摺動しう構成としたので、中速域以上ではバネの狭圧力のみで十分所定トルクの伝達ができ、カムフォロアは軸方向に摺動するだけで、回転方向に動くことなく可動プーリとベルトとの間に滑りを生ずることはなく、ベルトに無理な力がかかることもない。また、一方回転時においても低いトルク時、VベルトおよびVベルトの接触径が変化し、可動プーリと固定プーリの位相がずれ、カム面と接触子の位置が極端に離れ、この時急速に高負荷になったとき、スリップが発生しない。変速機の出力側にフライホイール等の慣性がかかる装置がある場合に、慣性

が大きく減速時に出力側が駆動側の作用をすることになり、カム面が反対側に移ってカムが働く。また、回転中で変速時は変速しないときの静摩擦係数から動摩擦係数にうつるので、摩擦係数が半分となり、プーリとベルトの伝達能力が半減するが、スリップが発生することがないのでベルトを長期間交換することなくしうできる。従って、変速機の回転数の高速制御、頻繁な正逆回転、或いは高負荷時において、加減速、正逆回転をする際に従動側のプーリとVベルトに緩みを生ずることがなく、スリップを生じないので、ベルトが炭化することなく、長期間使用できるので、廃棄が少なく公害の防止に役立つ。

【0022】また、オイル貯留部とカム面とをカムフォロアのオイル孔を通じて連通してオイル貯留部に貯留したオイルをカム面に常時供給しうるので、前記カム面の摩擦、摩耗を防止でき、長期に渡り注油することなく、円滑に変速できる。

【0023】以上の実施形態を示したが、この発明はこの形態に限定されるものではなく、この発明の要旨を逸脱しない範囲で、様々な形態を実施しうるものである。上記実施形態では、変速装置の出力側にトルクカム装置を備えた場合を説明したが、これに限られるものではなく、入力側に備えることもできる。

【0024】

【発明の効果】この発明によれば、前記遊動ボス部材に設けるカム面を、三角形のカム孔と軸線方向に延びた溝孔とを連続形成した構成とし、カム孔のストロークが短く、しかも低速側の間隔を狭めるため、変速装置の変速時にカム面の低速側において、カムフォロアに対してカムが遊ぶことなく、一側の傾斜面から他側の傾斜面に瞬時に移行して負荷がかかり、従って、可動プーリが戻ることないので、可動プーリとベルトに緩みを生じない。かつ高速側では、バネの狭圧力のみで十分所定トルクの伝達ができ、カムフォロアは溝孔に入り軸方向に摺動するだけで、可動プーリとベルトとの間に滑りを生ずることはなく、ベルトのスリップが発生しない。従って、無段変速機の変速時、トルクカム装置で高速域から低速域の変速全域でスリップの発生を防止し、ベルトの巻き込みを防止することができる。而して、回転数の高速制御、頻繁な正逆回転、高負荷時において、加減速、正逆回転の際に変速機の従動側のプーリとVベルトに緩みを生ずることがなく、スリップを生じないので、ベルトが炭化することなく、長期間使用できるので、廃棄が少なく公害の防止に役立つ。

【0025】この発明によれば、オイル貯留部とカム面とをカムフォロアのオイル孔を通じて連通してオイル貯留部に貯留したオイルをカム面に常時供給しうるので、前記カム面の摩擦、摩耗を防止でき、長期に渡り注油することなく、円滑に変速できる。

【図面の簡単な説明】

【図1】この発明のベルト式無段変速機の断面図である。

【図2】可変プーリの高速時の横断面図である。

【図3】同縦断面図である。

【図4】可変プーリの低速時の横断面図である。

【図5】同縦断面図である。

【図6】カム面の拡大平面図である。

【図7】従動軸と可動ボス部材の要部拡大断面図である。

【図8】従来のトルクカム装置を備えた変速機の高速時

の正面図である。

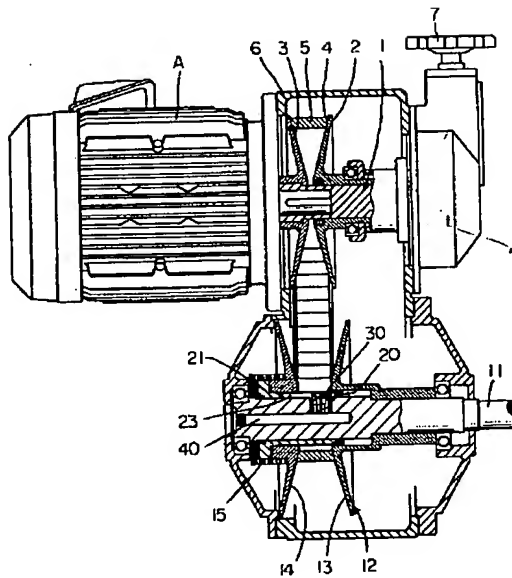
【図9】同低速時の正面図である。

【符号の説明】

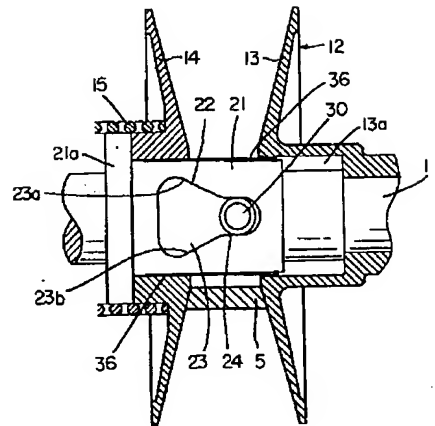
- 1 駆動軸
- 2 可変プーリ
- 11 従動軸
- 12 可変プーリ
- 13 固定プーリ
- 14 可動プーリ
- 15 バネ
- 20 トルクカム装置

- 21 可動ボス部材
- 22 カム面
- 23 三角形のカム孔
- 24 溝孔
- 30 カムフォロア
- 33 リング
- 34 オイル孔
- 35 オイル孔
- 40 オイル貯留部
- 10 43 オイル孔

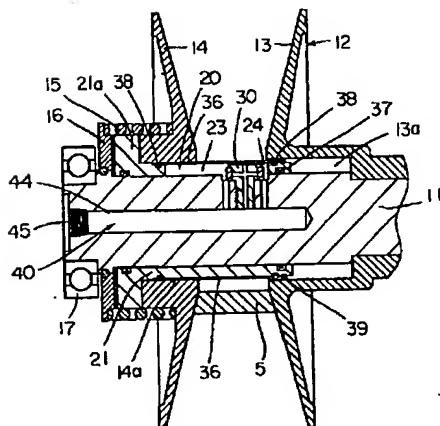
【図1】



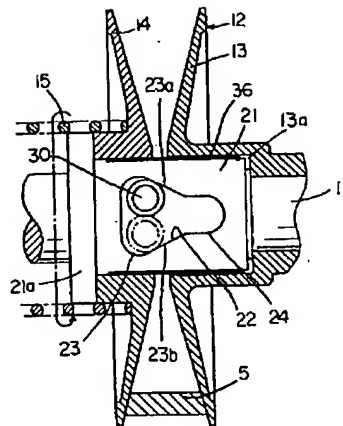
【図2】



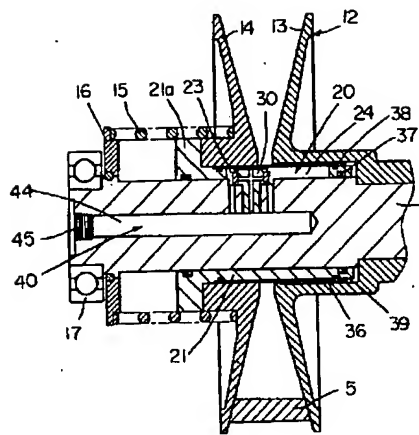
【図3】



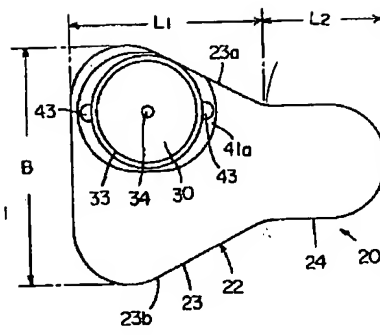
【図4】



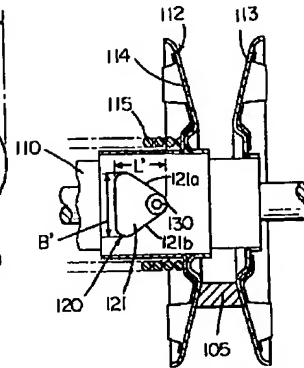
【図5】



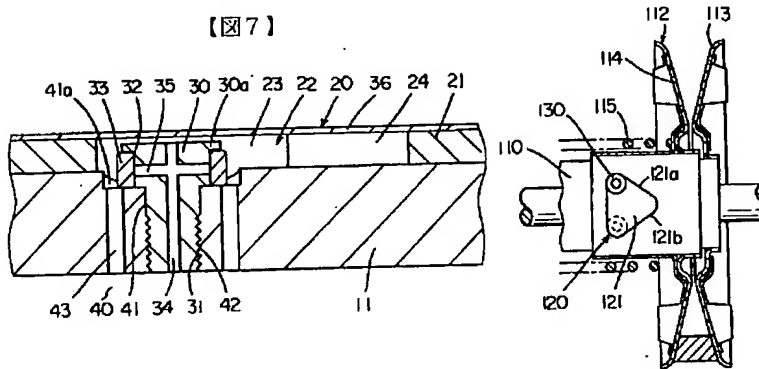
【図6】



【図8】



【図9】



PAT-NO: JP02002227949A

DOCUMENT-IDENTIFIER: JP 2002227949 A

TITLE: **BELT** TYPE CONTINUOUSLY VARIABLE TRANSMISSION

PUBN-DATE: August 14, 2002

INVENTOR-INFORMATION:

NAME

SAKAI, YOSHITAKA

COUNTRY

N/A

INT-CL (IPC): **F16H009/18**

ABSTRACT:

PROBLEM TO BE SOLVED: To prevent the generation of slip at the time of gear shifting of a continuously variable transmission over the whole gear shifting zone from a low to a high velocity by a torque cam device.

SOLUTION: A belt type continuously variable transmission is provided with a torque cam device 20 which is mounted in such a way as to be moved with the movable pulley of a driven shaft 11 and composed of a movable boss member 21, which forms a cam face 22 comprising a triangular cam hole 23, a groove hole 24, and a driven shaft 11. The cam hole 23 is symmetric with respect to a shaft line and can be contacted by a cam follower 30 in the shaft direction. The groove hole 24 is continued to the tip end of the cam hole and extended in the same direction as a shaft center, with the cam follower 30 sliding therein. The driven shaft 11 is provided with the cam follower 30 coming in contact with the cam face.

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Abstract Text - FPAR (1):

PROBLEM TO BE SOLVED: To prevent the generation of slip at the time of gear shifting of a continuously variable transmission over the whole gear shifting zone from a low to a high velocity by a torque cam device.

Abstract Text - FPAR (2):

SOLUTION: A belt type continuously variable transmission is provided with a torque cam device 20 which is mounted in such a way as to be moved with the movable pulley of a driven shaft 11 and composed of a movable boss member 21, which forms a cam face 22 comprising a triangular cam hole 23, a groove hole



24, and a driven shaft 11. The cam hole 23 is symmetric with respect to a shaft line and can be contacted by a cam follower 30 in the shaft direction. The groove hole 24 is continued to the tip end of the cam hole and extended in the same direction as a shaft center, with the cam follower 30 sliding therein. The driven shaft 11 is provided with the cam follower 30 coming in contact with the cam face.

Title of Patent Publication - TTL (1):

**BELT TYPE CONTINUOUSLY VARIABLE TRANSMISSION**

International Classification, Main - IPCO (1):

**F16H009/18**

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PRIOR ART

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[Description of the Prior Art] The drive shaft of a driving gear and the diameter pulley of adjustable [ 1st ] of rotation one which are conventionally shown in drawing 8 and drawing 9 as this kind of a V belt change gear, The diameter pulley 112 of adjustable [ 2nd ] which the fast pulley 113 fixed to the driven shaft 110 and the movable pulley 114 \*\*\*\*(ed) by the driven shaft were made to counter, and it had conducts with V belt 105. The 2nd diameter pulley 112 of adjustable has the triangle-like cam side 121 in the boss section 117 of a movable pulley while pressing the movable pulley 114 to a fast pulley 113 side with the spring 115 attached elastically back [ movable pulley 114 ]. There is a thing equipped with the torque cam mechanism 120 with which contact 130 which the tilt angle to an axis is fixed from the low speed of a gear change region to a high speed, and contacts a cam side at a driven shaft was formed (refer to JP,5-40354,Y).

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[Translation done.]

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EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention, by that of \*\* to which it considers as the configuration which carried out continuation formation of the slotted hole prolonged in triangular a cam hole and the direction of an axis in the cam side established in said ranging behavior boss member, and the stroke of a cam hole is short and moreover narrows spacing by the side of a low speed Since it shifts to the inclined plane of the side else from the inclined plane by the side of one in an instant, and a load is applied, therefore a movable pulley does not return, without a cam playing to a cam follower to the low-speed side of a cam side at the time of gear change of a change gear, slack is not produced to a movable pulley and a belt. And in a high-speed side, transfer of predetermined torque can be enough performed only by the compression force of a spring, a cam follower goes into a slotted hole, only slides on shaft orientations, and does not produce slipping between a movable pulley and a belt, and a slip of a belt does not generate it. Therefore, at the time of gear change of a nonstep variable speed gear, generating of a slip can be prevented throughout gear change of a low-speed area from a high-speed region with a torque cam mechanism, and the contamination of a belt can be prevented. Since it can be used for a long period of time, without a belt carbonizing since it \*\*, slack is not produced at the pulley and V belt by the side of the follower of a change gear in the case of acceleration and deceleration and forward inverse rotation at the time of high-speed control of a rotational frequency, frequent forward inverse rotation, and a heavy load and a slip is not produced, abandonment is useful to prevention of a public nuisance few.

[0025] It can change gears smoothly, without being able to prevent friction of said cam side, and wear and lubricating over a long period of time, since the firm gas of the oil which was open for free passage through the oil hole of a cam follower, and stored the oil reservoir section and a cam side in the oil reservoir section can be carried out to a cam side according to this invention.

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[Translation done.]

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MEANS

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[Means for Solving the Problem] The belt type nonstep variable speed gear of claim 1 of this invention Make the adjustable pulley 2 with which a driving shaft 1 is equipped, and the fast pulley 13 fixed to the follower shaft 11 and the movable pulley 14 \*\*\*\*(ed) by this follower shaft counter, and it has. In the change gear which rolled and carried out credit of the belt to the adjustable pulley 12 which attaches a spring 15 elastically behind this movable pulley, and always comes to prepare a movable pulley for a fast pulley in the shape of press The triangular cam hole 23 with which it prepares for the movable pulley 14 of the follower shaft 11 possible [ accessory movement ], and is symmetrical with an axis with the hole, and a cam follower 30 can contact shaft orientations, Let it be a summary to have had the torque cam mechanism 20 which consists of a movable boss member 21 in which the cam side 22 which consists of a slotted hole 24 prolonged in the same direction as the axial center on which a cam follower can slide succeeding the tip of this cam hole was formed, and a follower shaft 11 which formed the cam follower 30 contacted to this cam side 22.

[0006] Invention of claim 2 makes it a summary to have equipped the follower shaft 11 with the cam follower 30 which prepared the oil hole which forms the oil reservoir section 40 in the axial center of said follower shaft 11, and opens said oil reservoir section and said cam side for free passage in a belt type nonstep variable speed gear according to claim 1.

[0007] Since continuation formation of the slotted hole prolonged in triangular a cam hole and the direction of an axis in the above mentioned cam side which is established in said ranging behavior boss member according to the 1st configuration of invention was carried out The stroke of a cam hole is short, and moreover can narrow spacing by the side of a low speed, and it sets to the low-speed side of a cam side at the time of gear change of a change gear. Since it shifts to the inclined plane of the side else from the inclined plane by the side of one, and a load is applied immediately, therefore a movable pulley does not return, without a cam playing to a cam follower, slack is not produced to a movable pulley and a belt and a slip of a belt is not generated. Moreover, since it slides on shaft orientations, without a cam follower moving to a hand of cut since the high-speed side considered as the slotted hole, slipping is not produced between a movable pulley and a belt. Therefore, it can be used for a long period of time, without the contact surface of a belt carbonizing, since slack is not produced in the pulley and V belt by the side of the follower of a change gear at the time of high-speed control of an engine speed, frequent forward inverse rotation, and a heavy load and a slip is not produced. Therefore, the amount of abandonment of a belt is made few and is useful to prevention of a public nuisance.

[0008] It can change gears smoothly, without being able to prevent friction of said cam side, and wear and lubricating over a long period of time, since the firm gas of the above mentioned oil which was open for free passage through the oil hole of a cam follower, and stored the oil reservoir section and a cam side in the oil reservoir section can be carried out to a cam side according to the 2nd configuration of invention.

[0009]

[Embodiment of the Invention] The operation gestalt of this invention is explained based on a drawing. For this drawing of longitudinal section and drawing 4 , the cross-sectional view at the time of the low

speed of an adjustable pulley and drawing 5 R> 5 are [ the sectional view of a belt type nonstep variable speed gear whose drawing 1 is this invention, and drawing 2 / the cross-sectional view at the time of the high speed of an adjustable pulley, and drawing 3 / the expansion top view of a cam side and drawing 7 of this drawing of longitudinal section and drawing 6 ] the important section expanded sectional views of a follower shaft and a movable boss member.

[0010] In drawing 1 , the operation gestalt of the belt type nonstep variable speed gear of this invention is shown. A of driving gears, such as a motor, and 1 is [ a driving shaft (input shaft) and 2 ] the adjustable pulleys (adjustable V pulley) of a driving side, and it has the fast pulley 3 and the movable pulley 4. 5 is the actuation handle to which a V belt and 6 carry out casing of a change gear, and 7 carries out attitude actuation of the movable pulley, and it has it in relation to the driving shaft. By the ON OFF of the switch of a motor, a drive and a halt are performed and acceleration, moderation, and gear change are performed during a drive. The fast pulley 13 fixed to the follower shaft and the movable pulley 14 \*\*\*\*(ed) by this follower shaft are made to counter, and it has, and a spring 15 is attached elastically between the spring receptacles 16 of the movable pulley 14 in back, and 11 is a follower shaft (output shaft), 12 is an adjustable pulley by the side of a follower (adjustable V pulley), and it always has [ a movable pulley energizes and ] it to the fast pulley side. The spring receptacle 16 is fixed to the periphery of the follower shaft 11. 17 is bearing bearing. V belt 5 winds around the adjustable pulley 2 of said driving side, and the adjustable pulley 12 by the side of a follower almost, and is made them. A driving gear is not restricted to a motor and can use various engines.

[0011] This invention improves the structure of a torque cam mechanism in the above-mentioned nonstep variable speed gear. It sets to drawing 2 thru/or drawing 5 , and the torque cam mechanism at the time of the high speed of the adjustable pulley by the side of the follower of a nonstep variable speed gear and a low speed is shown. It has the torque cam mechanism 20 between the adjustable pulleys 2 which equip this follower shaft with said follower shaft 11 possible movable. Fitting hole 14a equipped with a movable boss member is prepared between the insides of the shank of the movable pulley 14 of the adjustable pulley 2 and the follower shafts 11 with which the follower shaft 11 is equipped, and guide hole 13a of the predetermined stroke to which a movable boss member can slide on a shank is formed in the fast pulley 13 of another side. It has the movable boss member 21 in which the cam side was formed so that it may have so that it may fit into the follower shaft 11, and it may fit into fitting hole 14a of said movable pulley 14, may be fixed and it may move together, and the movable pulley 14 can slide on shaft orientations to a fast pulley 13 and it may rotate also to a circumferencial direction.

[0012] a collar with the movable boss member 21 annular [ in drawing 6 and drawing 7 ] to a end face in the torque cam mechanism 20 of this invention -- it is the metal cylinder object which has 21a, and the cam side 22 is formed in one place of the peripheral surface of that cylinder object. fitting of this movable boss member 21 is carried out to fitting hole 14a of the operation pulley 14 -- having -- a collar -- it is contacted by the edge of the shank of a pulley, and is fixed to it, and accessory movement of 21a is enabled. The cam side 22 established in the peripheral surface of the movable boss member 21 is symmetrical with an axis, and is constituted by the triangular cam hole 23 with which a cam follower can contact shaft orientations, and the slotted hole 24 prolonged in the same direction as the axial center on which a cam follower 40 can slide succeeding the tip of this cam hole. That is, let the cam side 22 be the two-step cam which combined the triangular cam hole 23 and the triangular straight-line-like slotted hole 24.

[0013] The cam holes 23 are three square shapes which spread toward a shaft-orientations outside towards a movable pulley side from a fast pulley side, and a tilt angle is uniformly prepared for cam side 23a and cam side 23b in the symmetry toward a peripheral surface from an axis. The cam hole 23 of this triangle can do a stroke short, and since whenever [ that tilt-angle ] is moreover decided by relation with the load fastened according to the lateral pressure reinforcement of a belt, spacing by the side of a low speed can be made small. The straight-line-like slotted hole 24 makes the bore the diameter of said mostly with the outer diameter of a cam follower 30, it is prepared in the same direction as an axial center (axis) in the shape of a straight line, and a slotted hole enables sliding of it to a cam follower 30 only at shaft orientations. The die length of a slotted hole 24 sets up die length by beyond the middle-

speed range or high-speed region correspondence. In addition, the connection of a cam hole and a slotted hole attaches an R, and is taken as the shape of a smooth curve. Moreover, the both sides of the end face of the cam hole 23 are also made into the curved surface where the path of a cam follower may agree. Constituting the cam side 22 from the triangular cam hole 23 and the triangular straight-line-like slotted hole 24 By making the stroke of a cam small in a low-speed area, and narrowing spacing of one inclined plane of a cam hole, and the inclined plane of another side Slipping of a belt can be abolished by making shift distance of a cam follower 30 small at the time of forward reverse gear change, and abolishing the play of a cam, And since the compression force with the spring of the movable pulley which gives belt tension in the high-speed region above a middle-speed range is strong, the welding pressure by the inclination of a cam is unnecessary. Since it found out that it was not necessary to prepare the inclined plane of a cam side, and it did not have un-arranging only as for a straight-line-like slotted hole of the direction of an axis The straight-line-like slotted hole 24 of the direction of an axis is formed at the tip of the cam hole by the side of a high speed, the unnecessary part of a cam side is lost, and it enables it to change gears the relation between a cam and a cam follower without play also in any at the time of a low speed and a high speed.

[0014] In drawing 6, die-length L of the whole cam side 22 of the torque cam mechanism 20 is almost the same as overall-length L' of the conventional cam side, among those sets the die length of L1 and the straight-line-like slotted hole 24 to L2 for the die length of the triangular cam hole 23. The ratio of the die length L1 of the cam hole 23 of the cam side 22 and the die length L2 of the straight-line slotted hole 24 is decided by relation with the load which a cam fastens according to the lateral pressure reinforcement of a belt. In the example, as for the cam side 22, L1 is set up for a long time a little from L2. Whenever [ to the axis of a cam hole / tilt-angle ] determines whenever [ tilt-angle ] by relation with the load fastened according to the lateral pressure reinforcement of a belt. For example, the include angle of the inclined plane to the axis of a cam hole is made into about 45 or less degrees. By a diagram, it has considered as about 30 inclinations. Moreover, since the force which the die length of the slotted hole 24 of a high-speed region also requires for a belt above medium speed is small and torque is also small, it considers as the die length suitable for it. Moreover, let the maximum width B of the cam hole 23 be spacing on which a cam follower 30 does not slide at the time of gear change. Since this spacing can be made quite narrower than spacing of the cam shown in the conventional example, a cam follower 30 can contact immediately the inclined plane by the side of one, and the inclined plane of the side else and a load can be covered, there is no play of a cam and slipping of a belt is not produced. In addition, although L1 is set up for a long time a little from L2, the cam side 22

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the belt type nonstep variable speed gear equipped with the torque cam mechanism used for high-speed control of a rotational frequency, frequent forward inverse rotation, and the driving means that carries out heavy load fluctuation by the industrial machine, the machine tool, automobile, etc.

[0002]

[Description of the Prior Art] The drive shaft of a driving gear and the diameter pulley of adjustable [ 1st ] of rotation one which are conventionally shown in drawing 8 and drawing 9 as this kind of a V belt change gear, The diameter pulley 112 of adjustable [ 2nd ] which the fast pulley 113 fixed to the driven shaft 110 and the movable pulley 114 \*\*\*\*(ed) by the driven shaft were made to counter, and it had conducts with V belt 105. The 2nd diameter pulley 112 of adjustable has the triangle-like cam side 121 in the boss section 117 of a movable pulley while pressing the movable pulley 114 to a fast pulley 113 side with the spring 115 attached elastically back [ movable pulley 114 ]. There is a thing equipped with the torque cam mechanism 120 with which contact 130 which the tilt angle to an axis is fixed from the low speed of a gear change region to a high speed, and contacts a cam side at a driven shaft was formed (refer to JP,5-40354,Y).

[0003]

[Problem(s) to be Solved by the Invention] With the torque cam mechanism 120 of the above mentioned V belt change gear, it is fixed, and since it is large beyond the need, if spacing B' of the triangular cam side 121 changes to an inversion from normal rotation in the forward inversion in a low-speed area, a gear change belt will loosen and a slip will generate a tilt angle [ as opposed to / the triangle-like cam sides 51 established in the boss section of a movable pulley are all stroke L', and / an axis from the low speed of a gear change region to a high speed ]. Namely, although contact touches cam side 121a at the time of acceleration and touches cam side 121b at the time of moderation A triangular low-speed, i.e., triangular base, side without applying a load to a cam in the middle of large spacing which moves from one cam side to the cam side of another side, when spacing B' changes gears to acceleration from moderation from acceleration at moderation, since it is large In order that a cam may play and a movable pulley may return, slack is produced to a movable pulley and a belt and a slip is generated by the belt. Since the high-speed side of triangular top-most vertices or both sides are inclined planes, in order that contact may move also by slight fluctuation of torque, slipping is produced between a movable pulley and a belt. Moreover, on the other hand, at the time of rotation, the diameter of contact of a V belt and a V belt changes at the time of low torque, the phase of a movable pulley and a fast pulley shifts, and when the location of a cam side and contact separates extremely and this time becomes rapid a heavy load, there are problems, like a slip may be generated. Moreover, since it moves from a coefficient of static friction to a dynamic friction coefficient compared with the time of being under rotation and not changing gears at the time of gear change, coefficient of friction serves as half and the transfer capacity of a pulley and a belt is halved. since [ therefore, ] a slip continues unless load torque will decrease, once

a belt generates a slip -- the contact surface of a belt -- carbonizing -- just -- being alike -- fracture of a belt arises owing to it. If this belt that went out accumulates, that abandonment will also pose a problem of a public nuisance.

[0004] This invention aims at offering the belt type nonstep variable speed gear equipped with the torque cam mechanism which can prevent generating of a slip throughout gear change of a low-speed area from the high-speed region at the time of gear change as a cam side of the peculiar configuration which consists a cam side of a triangular cam hole and a linear slotted hole, in order to solve the above-mentioned conventional trouble.

[0005]

[Means for Solving the Problem] The belt type nonstep variable speed gear of claim 1 of this invention Make the adjustable pulley 2 with which a driving shaft 1 is equipped, and the fast pulley 13 fixed to the follower shaft 11 and the movable pulley 14 \*\*\*\*(ed) by this follower shaft counter, and it has. In the change gear which rolled and carried out credit of the belt to the adjustable pulley 12 which attaches a spring 15 elastically behind this movable pulley, and always comes to prepare a movable pulley for a fast pulley in the shape of press The triangular cam hole 23 with which it prepares for the movable pulley 14 of the follower shaft 11 possible [ accessory movement ], and is symmetrical with an axis with the hole, and a cam follower 30 can contact shaft orientations, Let it be a summary to have had the torque cam mechanism 20 which consists of a movable boss member 21 in which the cam side 22 which consists of a slotted hole 24 prolonged in the same direction as the axial center on which a cam follower can slide succeeding the tip of this cam hole was formed, and a follower shaft 11 which formed the cam follower 30 contacted to this cam side 22.

[0006] Invention of claim 2 makes it a summary to have equipped the follower shaft 11 with the cam follower 30 which prepared the oil hole which forms the oil reservoir section 40 in the axial center of said follower shaft 11, and opens said oil reservoir section and said cam side for free passage in a belt type nonstep variable speed gear according to claim 1.

[0007] Since continuation formation of the slotted hole prolonged in triangular a cam hole and the direction of an axis in the above mentioned cam side which is established in said ranging behavior boss member according to the 1st configuration of invention was carried out The stroke of a cam hole is short, and moreover can narrow spacing by the side of a low speed, and it sets to the low-speed side of a cam side at the time of gear change of a change gear. Since it shifts to the inclined plane of the side else from the inclined plane by the side of one, and a load is applied immediately, therefore a movable pulley does not return, without a cam playing to a cam follower, slack is not produced to a movable pulley and a belt and a slip of a belt is not generated. Moreover, since it slides on shaft orientations, without a cam follower moving to a hand of cut since the high-speed side considered as the slotted hole, slipping is not produced between a movable pulley and a belt. Therefore, it can be used for a long period of time, without the contact surface of a belt carbonizing, since slack is not produced in the pulley and V belt by the side of the follower of a change gear at the time of high-speed control of an engine speed, frequent forward inverse rotation, and a heavy load and a slip is not produced. Therefore, the amount of abandonment of a belt is made few and is useful to prevention of a public nuisance.

[0008] It can change gears smoothly, without being able to prevent friction of said cam side, and wear and lubricating over a long period of time, since the firm gas of the above mentioned oil which was open for free passage through the oil hole of a cam follower, and stored the oil reservoir section and a cam side in the oil reservoir section can be carried out to a cam side according to the 2nd configuration of invention.

[0009]

[Embodiment of the Invention] The operation gestalt of this invention is explained based on a drawing. For this drawing of longitudinal section and drawing 4, the cross-sectional view at the time of the low speed of an adjustable pulley and drawing 5 R> 5 are [ the sectional view of a belt type nonstep variable speed gear whose drawing 1 is this invention, and drawing 2 / the cross-sectional view at the time of the high speed of an adjustable pulley, and drawing 3 / the expansion top view of a cam side and drawing 7 of this drawing of longitudinal section and drawing 6 ] the important section expanded sectional views



of a follower shaft and a movable boss member.

[0010] In drawing 1 , the operation gestalt of the belt type nonstep variable speed gear of this invention is shown. A of driving gears, such as a motor, and 1 is [ a driving shaft (input shaft) and 2 ] the adjustable pulleys (adjustable V pulley) of a driving side, and it has the fast pulley 3 and the movable pulley 4. 5 is the actuation handle to which a V belt and 6 carry out casing of a change gear, and 7 carries out attitude actuation of the movable pulley, and it has it in relation to the driving shaft. By the ON OFF of the switch of a motor, a drive and a halt are performed and acceleration, moderation, and gear change are performed during a drive. The fast pulley 13 fixed to the follower shaft and the movable pulley 14 \*\*\*\*(ed) by this follower shaft are made to counter, and it has, and a spring 15 is attached elastically between the spring receptacles 16 of the movable pulley 14 in back, and 11 is a follower shaft (output shaft), 12 is an adjustable pulley by the side of a follower (adjustable V pulley), and it always has [ a movable pulley energizes and ] it to the fast pulley side. The spring receptacle 16 is fixed to the periphery of the follower shaft 11. 17 is bearing bearing. V belt 5 winds around the adjustable pulley 2 of said driving side, and the adjustable pulley 12 by the side of a follower almost, and is made them. A driving gear is not restricted to a motor and can use various engines.

[0011] This invention improves the structure of a torque cam mechanism in the above-mentioned nonstep variable speed gear. It sets to drawing 2 thru/or drawing 5 , and the torque cam mechanism at the time of the high speed of the adjustable pulley by the side of the follower of a nonstep variable speed gear and a low speed is shown. It has the torque cam mechanism 20 between the adjustable pulleys 2 which equip this follower shaft with said follower shaft 11 possible movable. Fitting hole 14a equipped with a movable boss member is prepared between the insides of the shank of the movable pulley 14 of the adjustable pulley 2 and the follower shafts 11 with which the follower shaft 11 is equipped, and guide hole 13a of the predetermined stroke to which a movable boss member can slide on a shank is formed in the fast pulley 13 of another side. It has the movable boss member 21 in which the cam side was formed so that it may have so that it may fit into the follower shaft 11, and it may fit into fitting hole 14a of said movable pulley 14, may be fixed and it may move together, and the movable pulley 14 can slide on shaft orientations to a fast pulley 13 and it may rotate also to a circumferencial direction.

[0012] a collar with the movable boss member 21 annular [ in drawing 6 and drawing 7 ] to a end face in the torque cam mechanism 20 of this invention -- it is the metal cylinder object which has 21a, and the cam side 22 is formed in one place of the peripheral surface of that cylinder object. fitting of this movable boss member 21 is carried out to fitting hole 14a of the operation pulley 14 -- having -- a collar -- it is contacted by the edge of the shank of a pulley, and is fixed to it, and accessory movement of 21a is enabled. The cam side 22 established in the peripheral surface of the movable boss member 21 is symmetrical with an axis, and is constituted by the triangular cam hole 23 with which a cam follower can contact shaft orientations, and the slotted hole 24 prolonged in the same direction as the axial center on which a cam follower 40 can slide succeeding the tip of this cam hole. That is, let the cam side 22 be the two-step cam which combined the triangular cam hole 23 and the triangular straight-line-like slotted hole 24.

[0013] The cam holes 23 are three square shapes which spread toward a shaft-orientations outside towards a movable pulley side from a fast pulley side, and a tilt angle is uniformly prepared for cam side 23a and cam side 23b in the symmetry toward a peripheral surface from an axis. The cam hole 23 of this triangle can do a stroke short, and since whenever [ that tilt-angle ] is moreover decided by relation with the load fastened according to the lateral pressure reinforcement of a belt, spacing by the side of a low speed can be made small. The straight-line-like slotted hole 24 makes the bore the diameter of said mostly with the outer diameter of a cam follower 30, it is prepared in the same direction as an axial center (axis) in the shape of a straight line, and a slotted hole enables sliding of it to a cam follower 30 only at shaft orientations. The die length of a slotted hole 24 sets up die length by beyond the middle-speed range or high-speed region correspondence. In addition, the connection of a cam hole and a slotted hole attaches an R, and is taken as the shape of a smooth curve. Moreover, the both sides of the end face of the cam hole 23 are also made into the curved surface where the path of a cam follower may agree. Constituting the cam side 22 from the triangular cam hole 23 and the triangular straight-line-like slotted

hole 24 By making the stroke of a cam small in a low-speed area, and narrowing spacing of one inclined plane of a cam hole, and the inclined plane of another side Slipping of a belt can be abolished by making shift distance of a cam follower 30 small at the time of forward reverse gear change, and abolishing the play of a cam, And since the compression force with the spring of the movable pulley which gives belt tension in the high-speed region above a middle-speed range is strong, the welding pressure by the inclination of a cam is unnecessary. Since it found out that it was not necessary to prepare the inclined plane of a cam side, and it did not have un-arranging only as for a straight-line-like slotted hole of the direction of an axis The straight-line-like slotted hole 24 of the direction of an axis is formed at the tip of the cam hole by the side of a high speed, the unnecessary part of a cam side is lost, and it enables it to change gears the relation between a cam and a cam follower without play also in any at the time of a low speed and a high speed.

[0014] In drawing 6, die-length L of the whole cam side 22 of the torque cam mechanism 20 is almost the same as overall-length L' of the conventional cam side, among those sets the die length of L1 and the straight-line-like slotted hole 24 to L2 for the die length of the triangular cam hole 23. The ratio of the die length L1 of the cam hole 23 of the cam side 22 and the die length L2 of the straight-line slotted hole 24 is decided by relation with the load which a cam fastens according to the lateral pressure reinforcement of a belt. In the example, as for the cam side 22, L1 is set up for a long time a little from L2. Whenever [ to the axis of a cam hole / tilt-angle ] determines whenever [ tilt-angle ] by relation with the load fastened according to the lateral pressure reinforcement of a belt. For example, the include angle of the inclined plane to the axis of a cam hole is made into about 45 or less degrees. By a diagram, it has considered as about 30 inclinations. Moreover, since the force which the die length of the slotted hole 24 of a high-speed region also requires for a belt above medium speed is small and torque is also small, it considers as the die length suitable for it. Moreover, let the maximum width B of the cam hole 23 be spacing on which a cam follower 30 does not slide at the time of gear change. Since this spacing can be made quite narrower than spacing of the cam shown in the conventional example, a cam follower 30 can contact immediately the inclined plane by the side of one, and the inclined plane of the side else and a load can be covered, there is no play of a cam and slipping of a belt is not produced. In addition, although L1 is set up for a long time a little from L2, the cam side 22 Although a size setup of the magnitude of a triangular cam hole can be carried out not by the thing limited to this but by relation with the load fastened according to the lateral pressure reinforcement of a belt as described above and being considered as the straight-line-like slotted hole with the operation gestalt above the middle-speed range A merits-and-demerits setup of the die length of a slotted hole can be carried out in relation, such as torque of accelerating in not the thing limited to this but a middle-speed range, and a high-speed region, and moderation.

[0015] It is prepared so that a cam follower is the metal axis which made head 30a the large path a little, a screw 31 is formed in the lower part, and the slot 32 annular to a peripheral face is formed in head 30a, rotation freedom is equipped with a ring 33 in this circular sulcus, the structure of a cam follower 30 may contact the cam side 22 and the peripheral face of this ring 33 may roll it, as shown in drawing 10, and a cam follower 30 may roll smoothly to the cam side 22. 1 or two or more oil holes 35 are formed in the location which the oil hole 34 penetrates at the core of this cam follower 30, and is established in it from upper limit to a lower limit, and is equivalent to the inside of said upside ring 32 from the central oil hole 34 in a hoop direction at a radial, and it enables it to supply oil to the inside of a ring 33. This cam follower 30 is made to project in said cam side, locates this cam follower 30 in the cam side 22, and makes a cam side contact to a cam follower 30 during a drive. The pulley of a cone plate is fastened by the force to the direction of a drive middle turn to inside, the force fastened is applied to a cam, a cam side is made into a pressure-welding condition at a cam follower, a cam side moves along with a cam follower at the time of gear change of acceleration and moderation, and a movable pulley and a movable boss member move together and slide to a fast pulley.

[0016] The oil reservoir section 40 which stores the oil of predetermined die length in the shaft orientations of an axial center is formed in the follower shaft (output shaft) 11, and the through tube 41 which fixes a cam follower to radial is formed even in the cam side of a periphery from this oil reservoir

section 40. The screw hole 42 which crevice 41a is formed in the shape of [ of the depth from which the lower part of that head goes into the upper part of this through tube 41 a little with a larger path a little than the outer diameter of the ring 33 with which head 30a of a cam follower 30 is equipped ] an ellipse, and the screw 31 of a cam follower 30 screws in the lower part of a through tube is formed. And the oil hole 43 which is the outside of the through tube 41 of the follower shaft 11, and led to 1 or two or more places from the reservoir section to crevice 41a of a periphery within ellipse-like crevice 41a in the location of the outside of the ring 34 of a cam follower 30 is formed. With an operation gestalt, the hole 44 of predetermined die length is formed in the direction of an axis from an axis end, the inlet port of a hole is equipped with a lid 45, and the oil reservoir section 40 puts in and stores the oil of requirements in the oil reservoir section 40 interior. It \*\*, and oil is always taken out to an inside-and-outside side through an oil hole with a centrifugal force, and a ring 33 is supplied to it. The screw 31 of said cam follower 30 is screwed in the screw hole 42 of this follower shaft 11, and from a crevice, the ring 33 of a head projects, and it has [ it is located in crevice 41a of a periphery, and ] it, and is contacted in the cam side 22 of said movable boss member 20. The firm gas of the oil is carried out to the cam side 22 from the oil reservoir section 40 through the oil hole 34 of a cam follower 30, and the firm gas of the oil is carried out through the external surface of a ring 33 in the cam side 22 through the inside and the oil hole 43 of a ring 33 from the oil reservoir section 40 from the oil hole 35.

[0017] As structure which seals oil, the step equivalent to a part for the thickness of covering is formed in the periphery of the cylinder object of the movable boss member 21, the wrap cylindrical boss covering 36 is inserted in the periphery of a up to near the edge in said whole cam side 22 from the step, and it is stopped and fixed by the stop member 39 at the end. Between the inside of this movable boss member 21, and the peripheral face of the follower shaft 11, it has oil IRU 37, and has O ring 38 between the periphery of the boss member 21, and the boss covering 36, and is made for oil not to leak outside.

[0018] Since this invention is the above mentioned configuration, the cam side of the movable boss member which moves together with a movable pulley to the cam follower 30 of a follower shaft is made to contact during a drive. That is, in a low-speed area, a cam side is moved along an inclined plane to a cam follower at the time of moderation at the time of acceleration, and it is moved to shaft orientations in a high-speed region. Moreover, the field of another side is made to shift from one field of a cam side promptly to a cam follower 30 at the time of gear change of right reverse, and it changes gears, without producing play.

[0019] At the time of the high speed of drawing 1 thru/or drawing 3 , V belt 5 is located in the bore of an adjustable pulley by the outer-diameter [ of an adjustable pulley ], and follower shaft side by the driving side. The movable pulley 14 of the follower shaft 11 deserts a fast pulley 13, and a spring 15 is compressed and is in a strong condition. Fitting of the slotted hole 24 of the cam side 22 of the movable boss member 21 which moves together with a movable pulley to the cam follower 30 of the follower shaft 11 at this time is carried out, and an output shaft drives from an input shaft in this condition. For example, if it slows down in this condition, a cam follower 30 will slide on shaft orientations along with the slotted hole of a cam. And since the pulley of a cone plate was fastened by the force to a hand of cut to inside and the force fastened is applied to the cam if a slotted hole 24 slides and comes out to a cam follower 30, the inclined plane of a cam is moved along with a cam follower 30.

[0020] At the time of the low speed of drawing 4 and drawing 5 , V belt 5 is located in the outer diameter of an adjustable pulley by the bore [ of an adjustable pulley ], and follower shaft side by the driving side. The movable pulley 14 of the follower shaft 11 approaches a fast pulley 13, and a spring 15 is extended and is in a weak condition. The inclined plane has touched and an output shaft drives the cam side 22 of the movable boss member 21 which moves together with a movable pulley to the cam follower 30 of the follower shaft 11 at this time from an input shaft to a hand of cut in this condition. If a driving side is reversed in this condition, it will shift to counter torque cam side 23b from one cam side 23a to a cam follower 30. And since between cam side 23a and 23b is below the conventional one half, counter torque cam side 23b touched to the cam follower 30 in an instant, the pulley of a cone plate was fastened by the force to a hand of cut to inside and the force fastened is applied to the cam, the inclined

plane of a cam is moved along with a cam follower 30.

[0021] Since a cam follower goes into a linear slotted hole above a middle-speed range when a gear change region is divided into a low-speed area, and medium speed and a high-speed region, this invention can perform transfer of predetermined torque enough only by the compression force of a spring, and is compressed only to a low-speed area by the triangular cam mechanism, and can transmit predetermined torque to it, therefore prevents generating of a slip throughout gear change of a low-speed area from a high-speed region, and prevents the contamination of a belt. Since the triangular cam hole had the short stroke and moreover also made small spacing by the side of a low speed Since a cam follower will touch an opposite inclined plane immediately from one inclined plane of a cam side and a cam does not play in middle when spacing which moves from one cam side to the cam side of another side can be narrowed and right reverse is changed gears by the low-speed area A movable pulley does not return, slack is not produced to a movable pulley and a belt, and a slip of a belt is not generated. Moreover, since the high-speed side considered the cam follower as the configuration to which only a predetermined stroke can slide in the direction of an axis as a slotted hole of the direction of an axis, above a middle-speed range, transfer of predetermined torque can be enough performed only by the compression force of a spring, and without only sliding on shaft orientations and moving to a hand of cut, a cam follower does not produce slipping between a movable pulley and a belt, and does not require the force with a belt impossible for. Moreover, on the other hand, at the time of rotation, the diameter of contact of a V belt and a V belt changes at the time of low torque, the phase of a movable pulley and a fast pulley shifts, and a slip is not generated, when the location of a cam side and contact separates extremely and this time becomes rapid a heavy load. When there is equipment which requires inertia, such as a flywheel, for the output side of a change gear, when inertia is large, an output side will carry out an operation of a driving side at the time of moderation, a cam side moves to the opposite side, and a cam works. Moreover, although coefficient of friction serves as half and the transfer capacity of a pulley and a belt is halved since it moves from the coefficient of static friction when being under rotation and not changing gears at the time of gear change to a dynamic friction coefficient, like can be carried out and carried out, without exchanging belts for a long period of time, since a slip is not generated. Therefore, since abandonment is useful to prevention of a public nuisance few since it can be used for a long period of time, and it leads to prevention of global warming, without a belt carbonizing since slack is not produced in the pulley and V belt by the side of a follower and a slip is not produced in case acceleration and deceleration and forward inverse rotation are carried out at the time of high-speed control of the rotational frequency of a change gear, frequent forward inverse rotation, or a heavy load, it is useful.

[0022] Moreover, it can change gears smoothly, without being able to prevent friction of said cam side, and wear and lubricating over a long period of time, since the firm gas of the oil which was open for free passage through the oil hole of a cam follower, and stored the oil reservoir section and a cam side in the oil reservoir section can be carried out to a cam side.

[0023] Although the above operation gestalt was shown, this invention is not limited to this gestalt, is the range which does not deviate from the summary of this invention, and can carry out various gestalten. Although the above-mentioned operation gestalt explained the case where the output side of a change gear was equipped with a torque cam mechanism, it is not restricted to this and can also prepare for an input side.

[0024]

[Effect of the Invention] According to this invention, by that of \*\* to which it considers as the configuration which carried out continuation formation of the slotted hole prolonged in triangular a cam hole and the direction of an axis in the cam side established in said ranging behavior boss member, and the stroke of a cam hole is short and moreover narrows spacing by the side of a low speed Since it shifts to the inclined plane of the side else from the inclined plane by the side of one in an instant, and a load is applied, therefore a movable pulley does not return, without a cam playing to a cam follower to the low-speed side of a cam side at the time of gear change of a change gear, slack is not produced to a movable pulley and a belt. And in a high-speed side, transfer of predetermined torque can be enough performed

only by the compression force of a spring, a cam follower goes into a slotted hole, only slides on shaft orientations, and does not produce slipping between a movable pulley and a belt, and a slip of a belt does not generate it. Therefore, at the time of gear change of a nonstep variable speed gear, generating of a slip can be prevented throughout gear change of a low-speed area from a high-speed region with a torque cam mechanism, and the contamination of a belt can be prevented. Since it can be used for a long period of time, without a belt carbonizing since it \*\*, slack is not produced at the pulley and V belt by the side of the follower of a change gear in the case of acceleration and deceleration and forward inverse rotation at the time of high-speed control of a rotational frequency, frequent forward inverse rotation, and a heavy load and a slip is not produced, abandonment is useful to prevention of a public nuisance few.

[0025] It can change gears smoothly, without being able to prevent friction of said cam side, and wear and lubricating over a long period of time, since the firm gas of the oil which was open for free passage through the oil hole of a cam follower, and stored the oil reservoir section and a cam side in the oil reservoir section can be carried out to a cam side according to this invention.

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[Translation done.]